PATENT ABSTRACTS OF JAPAN

(11)Publication number : **2000-021384**

(43)Date of publication of application : **21.01.2000**

(51)Int.Cl. H01M 2/26

H01M 4/80

H01M 10/04

H01M 10/30

(21)Application number : **10-187223**

(22)Date of filing : **02.07.1998**

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(54) **BATTERY**

(57)Abstract:
PROBLEM TO BE SOLVED: To surely weld a group of electrodes and a collecting boards together in a battery having a non-sintered type electrode.
SOLUTION: A battery is provided with a group of electrodes 4 comprising a first electrode 1 and a second electrode 2 constructed of a positive electrode and a negative electrode layered via a separator 3; an armor can 5 for housing the group of electrodes 4; and a collecting board 6 electrically connected to the first electrode and electrically connected to one side of a terminal. The first electrode 1 is a non-sintered type electrode of a metallic three-dimensional porous base board 9 filled with an active material, and provided with a band type connection part 7 the base board 9 exposed. The band type connection part 7 is welded a metallic thin plate 10 and is welded to a plurality of parts in the collecting board 6 so as to be electrically connected. The metallic thin plate 10 is 0.07 mm or more thick and thinner than 80% of that of the first electrode 1, with Vickers hardness ranging from 50 to 250. Alternatively, the collecting board 6 has Vickers hardness ranging from 50 to 250 and thickness of 0.1-1.5 mm.

[Claim(s)]
[Claim 1] The electrode group which is carrying out the laminating of the 1st plate (1) which consists of a positive-electrode plate and a negative-electrode plate, and the 2nd plate (2) through the separator (3) (4), Electrical connection is carried out to the sheathing can (5) which has contained this electrode group (4), and the 1st plate (1), and it has the collecting electrode plate (6) which connects the 1st plate (1) to one terminal electrically. The 1st plate (1) It has the band-like connection section (7) in which it is the non-sintering electrode which has filled up the substrate (9) of a metal three-dimension porous body with the active material, and the substrate (9) is exposed. In the cell which welds [in which this substrate (9) is

exposed / band-like connection] the metallic thin plate (10) (7), welds [of a collecting electrode plate (6) / two or more] the band-like connection section (7) to which joining of the metallic thin plate (10) was carried out, and comes to carry out electrical connection The cell characterized by for the metallic thin plate (10) by which joining is carried out to the band-like connection section (7) making thickness thinner than 80% of thickness of the 1st plate (1) by 0.07mm or more, and making Vickers hardness 250 or less or more by 50.
[Claim 2] The cell by which a collecting electrode plate (6) is indicated in Vickers hardness by claim 1 which is the metal plate which sets thickness to 0.1-1.5mm as 250 or less or more in 50.
[Claim 3] While it is an appearance smaller than a form among sheathing cans (5), and it is arranged in the edge of an electrode group (4) face to face and a collecting electrode plate (6) has two or more through tubes (6D) The cell indicated by claim 1 which has the projection (6E) projected toward the band-like connection section (7) of an electrode group (4) to the periphery of a through tube (6D), and which comes to carry out joining of the projection (6E) to the band-like connection section (7) of the 1st plate (1) in two or more parts.
[Claim 4] The cell by which a metal three-dimension porous body is indicated by claim 1 they are [claim] foaming nickel or a nickel fiber porous body.
[Claim 5] The cell indicated by claim 1 which the substrate of a metal three-dimension porous body is pressed in the band-like connection section (7), and it comes to compress into high density.
[Claim 6] The cell indicated by claim 1 which is disc-like [which a collecting electrode plate (6) approaches the edge of a swirl electrode, and it comes to arrange with the swirl electrode which an electrode group (4) carries out the laminating of the 1st plate (1) and the 2nd plate (2) through a separator (3), and comes to wind spirally].

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the cell which welded [electrode] the collecting electrode plate and raised the high-rate-discharge property.
[0002]
[Description of the Prior Art] As an electrode plate used for an alkaline cell etc., there are a sintering type electrode and a non-sintering electrode. It has been used that a sintering type electrode is conventionally in use and mostly. This electrode infiltrates solutions, such as nickel salt and a force DOMIUMU, salt, into a carbonyl nickel sintered compact, it carries out alkali treatment, active-material-izes, and is manufactured. However, since cost is reduced and it is made to a high energy consistency in recent years, the non-sintering electrode has become promising. A non-sintering electrode uses foaming nickel and metal three-dimension porous bodies, such as a nickel fiber porous body, as a substrate, fills up the opening of this substrate with a paste-like active material directly, and is manufactured.
[0003] Since a non-sintering electrode uses a metal three-dimension porous body for a substrate, like the punching metal used for the substrate of a sintering type electrode, it welds a lead plate to a substrate directly, and is not connectable with it. Since a metal three-dimension porous body has very few rates that almost all parts are openings and a metal part closes, even if it contacts a lead plate, it is because a touch area is restricted very small.
[0004] The technique which connects the substrate of a metal three-dimension porous body to a collecting electrode plate is indicated by the following official reports.
** JP,63-4562,A ** JP,2-220365,A [0005] ** The band-like connection section which does not fill up the official report of ** with an active material along with the edge of the substrate of a metal three-dimension porous body is prepared, a metallic thin plate is welded here, and the structure of connecting this part to a collecting electrode plate is indicated.
[0006] The electrode plate which welds [band-like connection] the metallic thin plate is spirally wound through a separator, and serves as an electrode group. A collecting electrode plate 6 is welded and this spiral electrode group can be collected, as shown in the exploded view of drawing 1 . As shown in this drawing, the cell which welds [electrode / 4] a collecting electrode plate 6 raises a high-rate-discharge

property, and can improve the discharge property in a high current. Lead plate 6A can be band-like connection welded [7 / a part of], and the electrode plate which welds the metallic thin plate can also be collected to it, as shown in the development view of drawing 2 . However, as shown in drawing 2 , it is difficult for the cell of the structure which welds lead plate 6A and collects a current to raise a high current discharge property. As shown in drawing 1 , the cell which connects the upper limit edge of the electrode group 4 used as the band-like connection section to a collecting electrode plate 6 in two or more parts has the features as for which current distribution which flows to an electrode plate is made to homogeneity.
[0007] The sectional view of drawing 3 shows the cross-section structure of the cell which connects a collecting electrode plate 6 to the top face of the electrode group 4. The cell of this structure has connected the inferior surface of tongue of a collecting electrode plate 6 to plate of one of the two in two or more parts at the band-like connection section 7. In order to connect plate of one of the two to a collecting electrode plate 6, one electrode plate is projected more nearly up than the electrode plate of another side. The lobe of an electrode plate is the band-like connection section 7 which welds the metallic thin plate 10. As shown in the sectional view of drawing 4 , the electrode group of this structure presses a collecting electrode plate 6 on the top face, and resistance electric welding of it is carried out to a collecting electrode plate 6, and it is connected to it.
[0008]
[Problem(s) to be Solved by the Invention] It is very difficult for the cell of the above structure to connect the band-like connection section of a substrate in the condition ideal for a collecting electrode plate. In order to connect certainly two or more parts of the band-like connection section to a collecting electrode plate especially, it is necessary to press and carry out resistance electric welding of the collecting electrode plate to the band-like connection section by the considerable pressure. It is because the electric resistance between the joining segments of a collecting electrode plate and the band-like connection section becomes large and it stops being able to carry out electric welding of it normally, when thrust of a collecting electrode plate is weakened. If resistance electric welding of a collecting electrode plate and the band-like connection section is carried out in the condition that electric resistance is big, a welder will make high the electrical potential difference impressed between a collecting electrode plate and the band-like connection section, in order to pass constant current. If a high electrical potential difference is impressed, it comes to carry out arc discharge between a collecting electrode plate and the band-like connection section, resistance falls rapidly, and it will be in the condition that large power is supplied to a weld, and the contact section dissolves in an instant and scatters and of being called the so-called "explosion." If it will be in this condition, it will become impossible to connect normally a collecting electrode plate and the band-like connection section.
[0009] It is very difficult for especially the cell that pastes up two or more parts of a collecting electrode plate on the band-like connection section in order to make internal resistance of a cell small to connect in the ideal condition by all the parts that connect the band-like connection section and a collecting electrode plate. It is because the top face of the band-like connection section and the inferior surface of tongue of a collecting electrode plate are not processible into a perfect flat surface. Especially the collecting electrode plate that two or more through tubes are prepared, a projection is caudad prepared in the periphery of a through tube, and this projection is contacted in the band-like connection section, and carries out electric welding is very difficult for making an inferior surface of tongue into a perfect plane actually.
[0010] By pressing a collecting electrode plate in an electrode group strongly, the band-like connection section and a collecting electrode plate can be contacted without a clearance. Therefore, if a collecting electrode plate is band-like connection welded in this condition, a collecting electrode plate and the band-like connection section can certainly be welded. However, if a collecting electrode plate is strongly pressed in the band-like connection section and is welded, as shown in drawing 5 and drawing 6 , the band-like connection section 7 will bend and it will become the cause of internal short-circuit. It is because the bent part breaks through a separator 3 and other terminals are contacted. A discontinuous part becomes weak and especially the band-like connection section 7 that welds the metallic thin plate 10 has the property which is easy to bend on a restoration boundary. Furthermore, the non-sintering electrode which has filled up the substrate of a metal three-dimension porous body with the active material will be

easy to deform, if the reinforcement of a substrate is weak and presses a collecting electrode plate strongly.
[0011] therefore -- if the pressure which internal short-circuit will increase and will press a collecting electrode plate in an electrode group on the contrary if the conventional cell is strongly pressed in an electrode group and welds a collecting electrode plate is weakened and is welded -- a collecting electrode plate and an electrode group -- low -- there was a fault it becomes impossible to weld in the condition [****]. A cell is the impact are shocked when it falls, and the amount of welding may be able to stop furthermore, being able to exfoliate and use it. Especially the cell that was excellent in the high current property which welds the band-like connection section of an electrode group in two or more parts has the fault to which the incidence rate of the defective by the impact becomes high as compared with the cell which has connected the electrode group to a terminal through a long and slender lead plate. That is because there is little capacity which deforms freely like a lead plate and absorbs an impact.
[0012] what was developed for the purpose of this invention solving the above conventional faults -- it is -- the important purpose of this invention -- the band-like connection section of an electrode group -- low -- it can certainly two or more weld [of a collecting electrode plate] in the condition [****], and further, there is little internal short-circuit in the process which welds a collecting electrode plate, and, moreover, it is to offer the cell which was excellent in the impact property-proof.
[0013]
[Means for Solving the Problem] The cell of this invention has the following structures, in order to attain the above-mentioned purpose. Electrical connection of the cell is carried out to the electrode group 4 which is carrying out the laminating of the 1st plate 1 which consists of a positive-electrode plate and a negative-electrode plate, and the 2nd plate 2 through the separator 3, the sheathing can 5 which has contained this electrode group 4, and the 1st plate 1, and it is equipped with the collecting electrode plate 6 which connects the 1st plate 1 to one terminal electrically.
[0014] The cell which the cell which uses the 1st plate as a positive-electrode plate uses the 2nd plate as a negative-electrode plate, and uses the 1st plate as a negative-electrode plate uses the 2nd plate as a positive-electrode plate.
[0015] The 1st plate 1 is a non-sintering electrode which has filled up the substrate 9 of a metal three-dimension porous body with the active material, and has the band-like connection section 7 in which the substrate 9 is exposed. This band-like connection section 7 welds [in which the metal three-dimension porous body is exposed / band-like connection / 7] the metallic thin plate 10. The band-like connection section 7 which welds the metallic thin plate 10 was two or more welded [of the collecting electrode plate 6], and is connected electrically.
[0016] Furthermore, the cell of claim 1 of this invention makes Vickers hardness 250 or less or more by 50 while the thickness of the 1st plate 1 is thinner than 80% and it carries out thickness of the metallic thin plate 10 band-like connection welded [7] by 0.07mm or more.
[0017] The cell of claim 2 of this invention uses the metal plate which sets thickness to 0.1-1.5mm for Vickers hardness as 250 or less or more by 50 for a collecting electrode plate 6.
[0018] A collecting electrode plate 6 is an appearance smaller than a form among the sheathing cans 5, and the cell of claim 3 of this invention is countered and arranged in the edge of the electrode group 4. Furthermore, the collecting electrode plate 6 has prepared two or more through tube 6D. Through tube 6D has projection 6E projected toward the band-like connection section 7 of the electrode group 4 to the periphery. Joining of the projecting projection 6E is carried out to the band-like connection section 7 of the 1st plate 1 in two or more parts.
[0019] The cell of claim 4 of this invention uses a metal three-dimension porous body as foaming nickel or a nickel fiber porous body.
[0020] The cell of claim 5 of this invention pressed the band-like connection section 7 of the substrate 9 of a metal three-dimension porous body, and has compressed it into high density.
[0021] The cell of claim 6 of this invention carries out the laminating of the 1st plate 1 and the 2nd plate 2 through a separator 3, and is using the swirl electrode which it comes to wind spirally for the electrode group 4. A collecting electrode plate 6 is disc-like [which is approached and arranged in the edge of a

swirl electrode].
[0022]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing. However, the gestalt of operation shown below does not illustrate the cell for materializing the technical thought of this invention, and this invention does not specify a cell as the following.
[0023] Furthermore, this specification has appended the number corresponding to the member shown in the gestalt of operation to the member shown in "the column of a claim", and "the column of The means for solving a technical problem" so that it may be easy to understand a claim. However, there is never nothing what specifies the member shown in a claim as the member of the gestalt of operation.
[0024] The cell shown in drawing 7 is equipped with the electrode group 4 inserted in the sheathing can 5 and this sheathing can 5 of the shape of a cylinder airtightly sealed with the obturation plate 11, and the collecting electrode plate 6 which connects the electrode group 4 to the terminal 12 of the sheathing can 5. Although the cell shown in drawing makes the sheathing can cylindrical, this invention does not specify the sheathing can of a cell in the shape of a cylinder. Although a sheathing can is not illustrated, it can also be made square tubed thru/or ellipse tubed, for example.
[0025] The sheathing can 5 is iron and is carrying out nickel plating of the front face. As for the quality of the material of the sheathing can 5, the optimal metal is chosen in consideration of the class and property of a cell. A sheathing can may be made into stainless steel, aluminum, and the product made from an aluminium alloy. The metal sheathing can has sealed opening of upper limit airtightly by the lid. Lids are approaches, such as carrying out laser welding of the boundary of a lid to the structure of closing a sheathing can, or a sheathing can, and are fixed airtightly. The obturation plate 11 is fixing one terminal 12 of a cell. This terminal 12 is insulated and fixed to a sheathing can.
[0026] The cell of this invention is the cell having a non-sintering electrode, for example, a nickel hydoride battery. However, this invention does not specify a cell as a nickel hydoride battery. It can also consider as a nickel-cadmium battery, a lithium ion battery, etc. at a cell. Hereafter, the gestalt of operation of a nickel hydoride battery is explained in full detail as a gestalt of desirable operation.
[0027] The electrode group 4 has wound the 1st plate 1 and the 2nd plate 2 through a separator 3. The cell shown in drawing uses as a positive-electrode plate the 1st plate 1 connected to a collecting electrode plate 6, and is using the 2nd plate 2 as the negative-electrode plate. However, this invention can also use the 2nd plate as a positive-electrode plate by using the 1st plate as a negative-electrode plate. The 1st plate 1 and the 2nd plate 2 by which the laminating was carried out through the separator 3 are wound, and are manufactured by the spiral electrode group 4. The spiral electrode group 4 is inserted in the cylinder-like sheathing can 5. A spiral electrode group can be pressed from both sides, can be made to be able to deform into an ellipse form, and can be inserted in the sheathing can of an ellipse form. Furthermore, the electrode group inserted in an rectangular pipe-like sheathing can carries out the laminating of the 1st plate of two or more sheets and the 2nd plate which were cut out by tabular through a separator, and is manufactured.
[0028] As for a separator 3, the nonwoven fabric made from polyolefine is used. However, fine porosity film made of synthetic resin, such as polyethylene, can also be used for a separator 3. All the web materials that can insulate the 1st plate 1 and the 2nd plate 2 by which a laminating is carried out to both sides, and can permeate the electrolytic solution can be used for a separator 3.
[0029] The 1st plate 1 is a non-sintering electrode which has filled up the substrate 9 of a metal three-dimension porous body with the active material. The substrates 9 of a metal three-dimension porous body are a foaming nickel porous body, a nickel fiber porous body, etc. The 1st plate 1 has filled up the substrates 9, such as this, with the active material.
[0030] The substrate of the 1st plate 1 forms the band-like connection section 7 in the upper part of a substrate 9, as shown in the development view of drawing 8 , and other parts are made into the active material restoration section 8 filled up with the active material. The band-like connection section 7 removes the active material filled up with or filled up with the active material, and is exposing the substrate 9. Preferably, a substrate 9 is pressed in the band-like connection section 7, and is compressed into high density. The compressed band-like connection section 7 has the features which can certainly

weld a metallic thin plate.
[0031] In order to connect electrically certainly with a collecting electrode plate 6, the band-like connection section 7 is fixing the metallic thin plate 10, as shown in the sectional view of drawing 9 . A metallic thin plate 10 is pasted up in the condition of carrying out resistance electric welding or connecting with the band-like connection section 7 electrically through a conductive binder.
[0032] The thickness of a metallic thin plate 10 is 0.07mm or more, and is thinner than 80% of thickness of the 1st plate 1. When a metallic thin plate 10 is made thinner than 0.07mm, the reinforcement when welding the band-like connection section to a collecting electrode plate becomes less enough. If the thickness of a metallic thin plate becomes thicker than 80% of the 1st plate 1 on the contrary, where the laminating of the 1st plate and the 2nd plate is carried out through a separator, the band-like connection section will become thick and space efficiency will fall. Thickness of a metallic thin plate is preferably set to 0.095-0.2mm.
[0033] Furthermore, the metallic thin plate which a metallic thin plate makes Vickers hardness 50 or more, and is made or less into 250 is used. The reinforcement when welding the band-like connection section as the degree of hardness of a metallic thin plate is 50 or less becomes less enough, when a cell is shocked, the band-like connection section separates from a collecting electrode plate, and impact strength-proof falls. If the Vickers hardness of a metallic thin plate becomes larger than 250, when the band-like connection section is welded, a metallic thin plate breaks through a separator, and it is easy to carry out internal short-circuit, and impact strength also falls. Therefore, the sheet metal of the metal which sets Vickers hardness to 50-250 and the sheet metal of the metal which sets Vickers hardness to 170-200 preferably, for example, nickel sheet metal, phosphorus nickel sheet metal, the sheet metal that carried out nickel plating to iron are used for a metallic thin plate.
[0034] The 1st plate 1 of drawing 9 has adhered masking tape 13 to the opposed face with the 2nd plate 2 of the band-like connection section 7. Masking tape 13 has extended the lower limit edge to a lower part rather than the restoration boundary. When pressing and welding a collecting electrode plate 6 to the band-like connection section 7, it is for preventing a restoration boundary bending and breaking through a separator. The cell which has pasted up masking tape 13 here prevents internal short-circuit, and has the features that a collecting electrode plate 6 is certainly connectable with the band-like connection section 7. However, the band-like connection section is also connectable with a collecting electrode plate in the condition of not using masking tape.
[0035] A collecting electrode plate 6 cuts a metal plate to disc-like [among the sheathing cans 5 / smaller than a form], and makes lead plate 6A project, as it is the metal plate which carried out nickel plating to iron, or metal plates, such as a nickel plate, and is shown in drawing 10 . A collecting electrode plate 6 is arranged so that it may counter at the both ends of the electrode group 4. Although the collecting electrode plate 6 shown in drawing 10 is not illustrated, for example since the cell of this invention is not specified as a cylindrical shape cell, although it is circular, in order that the sheathing can 5 of a cell may use it for the cell which is a cylindrical shape, it can use a rectangle-like collecting electrode plate for a square shape cell.
[0036] The collecting electrode plate 6 has prepared slit 6C in the both sides of feed-hole 6B, in order to lessen the reactive current when carrying out resistance electric welding. Furthermore, opening of two or more through tube 6D is carried out. As shown in the expanded sectional view of drawing 11 , projection 6E which projects caudad is provided in the periphery of through tube 6D. Projection 6E is welded and connected to the band-like connection section 7 of the 1st plate 1 in two or more parts. Lead plate 6A of a collecting electrode plate 6 is connected to the terminal 12 fixed to opening of the sheathing can 5 by insulating.
[0037] A collecting electrode plate is a metal plate which sets thickness to 0.1-1.5mm for Vickers hardness as 250 or less or more by 50. Even if a collecting electrode plate makes Vickers hardness 50 or less, makes Vickers hardness 250 or more for thickness also as 0.1mm or less or makes thickness thicker than 1.5mm, it becomes impossible to certainly band-like connection weld it.
[0038] Since there is no sufficient reinforcement, the collecting electrode plate which makes Vickers hardness 50 or less, or sets thickness to 0.1mm or less presses the electrode for welding locally, and it

becomes impossible to certainly weld the contact part of the band-like connection section and a collecting electrode plate. It is because a collecting electrode plate deforms. When pressing the electrode for welding locally, it becomes impossible furthermore, for the collecting electrode plate which makes Vickers hardness 250 or more, or sets thickness to 1.5mm or more to also certainly weld the contact part of the band-like connection section and a collecting electrode plate. It is because a collecting electrode plate hardly deforms.

[0039] When the band-like connection section is welded, in a part for the welding of the band-like connection section and a collecting electrode plate, it is important to contact a contact part in the uniform condition. Whether it does not deform at all or the deformation of a collecting electrode plate is too large, it becomes impossible to contact homogeneity in a weld in the condition of being locally pressed with a welding electrode rod. If deformation is too large, although the weld of near pressed with a welding electrode rod is pressed strongly, its contact of the weld in the part which is separated from a welding electrode rod will be weak, or will leave it. If a collecting electrode plate does not deform at all, only the weld in which a collecting electrode plate and the band-like connection section project contacts strongly, and other welds stop moreover, contacting. Welds are contacted [no] to homogeneity and it becomes impossible for this reason, to weld in the ideal condition.

[0040] Furthermore, if a collecting electrode plate makes Vickers hardness 250 or more or thickness is set to 1.5mm or more, when connecting the band-like connection section, the rate which the 1st plate and the 2nd plate break through a separator and carries out internal short-circuit becomes high, and it reduces a yield. That is because deformation of the collecting electrode plate pressed with a welding electrode rod becomes small, the band-like connection section pressed by the collecting electrode plate in the condition of projecting mutually bends and a separator 3 is broken through.

[0041] Furthermore, even if a collecting electrode plate makes Vickers hardness 50 or less, it makes Vickers hardness or more into 250 for thickness also as 0.1mm or less or it makes thickness thicker than 1.5mm, impact strength-proof falls. Since the collecting electrode plate 6 which makes Vickers hardness 50 or less, or sets thickness to 0.1mm or less does not have sufficient reinforcement, when shocked, joining with the band-like connection section separates, and impact strength-proof falls. Moreover, since [which makes Vickers hardness 250 or more, or does not deform at all when a collecting electrode plate thicker than 1.5mm is shocked] in other words there is no buffer action, it is easy to separate from a part for the welding of the band-like connection section and a collecting electrode plate, and impact strength-proof falls.

[0042]

[Example] At the following processes, the cylindrical nickel hydoride battery of SC size was made as an experiment, the thickness of a metallic thin plate, Vickers hardness, and the Vickers hardness of a collecting electrode plate were changed, and each rate of an excellent article was measured.

[0043] At the following processes, the electrode group inserted in the sheathing can of a nickel hydoride battery was manufactured.

a. Manufacture of the positive-electrode plate which is the 1st plate (1) A metal porous body is produced at the following process. It is immersed in the plating liquid of a cell and the organic porous body of the shape of sponge which is polyurethane foam of an open cell is plated, after carrying out electric conduction processing. Predetermined time calcining of the plated organic porous body is carried out at the temperature of 750 degrees C, the resinous principle of an organic porous body is removed, further, it sinters by reducing atmosphere and a metal porous body is manufactured. The metal porous body manufactured at this process is foaming nickel which makes eyes about 600 g/m2, makes porosity 95%, and sets thickness to about 2.0mm.

[0044] (2) Knead the following and consider as the active material slurry of a positive electrode.

Nickel hydroxide powder ..... 90 weight sections (they are contained using a 2.5wt% zinc and 1wt% cobalt as a coprecipitation component)

Cobalt powder ..... Ten weight sections Zinc-oxide powder ..... Three weight sections 0.2 % of the weight water solution of hydroxypropylcellulose .. 50 weight sections [0045] (3) The opening of a metal porous body was filled up with the active material slurry of the produced positive

electrode. The fill was adjusted so that the active material consistency after roll rolling might serve as about 2.91g/cc-void. Then, it dried, and opening-RU rolling was performed so that thickness might be set to about 0.70mm. Furthermore, it cut in the shape of a strip of paper, and the ultrasonic exfoliation which adds vertical supersonic vibration removed the active material to the band-like connection section 7 which welds a metallic thin plate 10. And as shown in drawing 8 , it considers as the 1st plate 1 with the band-like connection section 7 which a substrate 9 exposes.

[0046] The 1st plate can also manufacture an active material at the following processes. As shown in drawing 12 , before being filled up with an active material, roll rolling of the metal porous body is carried out in parallel by predetermined width of face. Width of face of roll rolling is set to about 5 twice as manymm as the width of face of the band-like connection section 7, and sets thickness after rolling to 0.5mm. Thus, the above-mentioned active material slurry is filled up with and rolled out to the substrate 9 of a metal porous body rolled out. Then, it cuts in the location shown by the arrow head of drawing 12 , and the strip-of-paper-like 1st plate is produced. Then, along with the part used as the band-like connection section 7 rolled out thinly, a compressed air is injected, or a brush etc. is used, an active material is removed, and a substrate is exposed.

[0047] (4) Paste up a metallic thin plate 10 on the band-like connection section 7 which the substrate 9 exposed by resistance electric welding. Copper with a diameter of 1.5mm was used for adhesion with the band-like connection section 7 and a metallic thin plate 10 as a welding electrode rod, and carried out resistance electric welding to it at intervals of 2mm. The nickel ribbon was used for the metallic thin plate 10, and it considered as width of face of 1.5mm.

[0048] Two or more prototype cells are produced by making the thickness and Vickers hardness of a metallic thin plate into a parameter. The prototype cells 1-13 have set up the thickness of a metallic thin plate in 0.01-0.50mm. The metallic thin plate used at this time is the nickel ribbon of width of face of 1.5mm, and Vickers hardness 150, and the collecting electrode plate used the iron which carried out nickel plating with a Vickers hardness [150] and a thickness of 0.40mm.

[0049] Furthermore, the Vickers hardness of a metallic thin plate is changed to 30-350, and the prototype cells 14-22 are produced. The metallic thin plate used at this time is a nickel ribbon which sets width of face of 1.5mm, and thickness to 0.07mm, and the collecting electrode plate used the iron which carried out nickel plating with a Vickers hardness [150] and a thickness of 0.40mm as well as the above.

[0050] b. Manufacture of the negative-electrode plate which is the 2nd plate (1) Weighing capacity of the manganese is carried out to 1.0:3.4:0.8:0.2:0.6 by the element ratio, and it mixes with production and the grinding misch metal (mixture of rare earth elements, such as La, Ce, Nd, and Pr) of a hydrogen storing metal alloy, nickel, cobalt, and aluminum, after putting this into a crucible and fusing with a RF fusion furnace, it cools, and the hydrogen storing metal alloy electrode of the following empirical formula is produced.

After carrying out coarse grinding of Mm1.0nickel3.4Co0.8aluminum0.2Mn0.6 and the obtained ingot of a hydrogen storing metal alloy beforehand, it is ground so that mean particle diameter may be set to 60 micrometers in inert gas.

[0051] (2) Add polyethylene oxide powder as a binder to the powder of the hydrogen storing metal alloy in which the hydrogen storing metal alloy slurry carried out production grinding, add and knead ion exchange water further to it, and consider as a slurry. The addition of the polyethylene oxide powder which is a binder is made into 1.0 % of the weight to a hydrogen storing metal alloy.

[0052] (3) Both sides of the substrate which is a punching metal were plastered with the slurry. The amount of application was adjusted so that the active material consistency after rolling might be set to cc in 5g /. Then, after performing desiccation and rolling, it cut in the predetermined dimension and considered as the negative-electrode plate which is the 2nd plate. The slurry left and applied the margo inferior so that the band-like connection section 7 might be made to the margo inferior of a punching metal. Moreover, after applying a slurry all over a punching metal, it can dry, the active material of the margo inferior can be removed, and the band-like connection section can also be prepared.

[0053] The 1st plate manufactured at the above process and the 2nd plate were wound through SEBARETA which consists of a nonwoven fabric made from polyolefine, it considered as the spiral

electrode group, and the swirl electrode was produced. A collecting electrode plate is welded [which projects at the upper limit edge of this swirl electrode / 10] in resistance electric welding. The iron plate which carried out nickel plating with a thickness of 0.40mm by disc-like was used for the collecting electrode plate. As a parameter of a prototype cell, the Vickers hardness of this collecting electrode plate was changed by 30-350, and produced the prototype cells 23-31.

[0054] The 1st plate and the 2nd plate which were produced by the above approach were used, and the prototype cell of a cylindrical nickel hydoride battery was produced.

[0055] The [prototype cell 1-13] prototype cells 1-13 are set up in 0.01-0.50mm by making thickness of a metallic thin plate into a parameter. The iron plate which used the nickel ribbon of width of face of 1.5mm and Vickers hardness 150, and performed nickel plating with a Vickers hardness [150] and a thickness of 0.40mm as a collecting electrode plate as a metallic thin plate was used.

[0056] The thickness of the metallic thin plate 10 of each prototype cell was changed in 0.01-0.50mm, and produced the prototype cell to 1-13. 0.01-0.07mm was changed every 0.02mm, and thickness was changed every 0.05mm henceforth to 0.10mm - 0.50mm.

[0057] The rate of an excellent article of the prototype cells 1-13 made as an experiment as mentioned above is measured. In here, the rate of an excellent article expresses the number of the excellent articles over 100 cells, and it has judged by the ability for there to be especially a terminal and use it for a connection condition. That is, each prototype cell produced the 100 cells same about one condition, respectively, and carried out counting of the number of the excellent article of them.

[0058] Here, three, the rate of a welding excellent article, the rate of an assembly excellent article, and the rate of an impact excellent article, were measured as a rate of an excellent article. The rate of a welding excellent article is the phase which welded the metallic thin plate and the collecting electrode plate in the production process of a cell, and the rate that a terminal is normal is shown immediately after the rate which can be used at the following process, i.e., joining. Moreover, an assembly percent defective shows the rate that a terminal is normal, immediately after manufacture of the cell made into 100% of rates of a welding excellent article without the internal short-circuit for which the 1st plate and the 2nd plate short-circuit at the time of production process termination, i.e., a rate, when production of a cell is continued using the terminal welded normally. Furthermore, an impact defective shows the rate that a terminal does not exfoliate even if a cell gives an usable rate that is, and gives an impact to the cell assembled normally, after dropping the completed normal cell 100 times on a griddle from height of 1m.

[0059] The result of having measured the rate of a welding excellent article of the cell which set thickness of a metallic thin plate to 0.01-0.50mm, the rate of an assembly excellent article, and the rate of an impact excellent article is shown in Table 1.

[0060]

[Table 1]

金属薄板の厚さを０．０１～０．５０mmとした場合の溶接良品率、組立良品率、衝撃良品率

試作電池	金属薄板の厚さ (mm)	溶接良品率 (%)	組立良品率 (%)	衝撃良品率 (%)
1	0.01	3	99	25
2	0.03	15	99	45
3	0.05	80	99	80
4	0.07	98	99	98
5	0.10	99	99	99
6	0.15	99	99	99
7	0.20	99	99	99
8	0.25	99	99	99
9	0.30	99	99	99
10	0.35	99	99	99
11	0.40	99	99	99
12	0.45	99	60	99
13	0.50	99	20	99

[0061] As shown in Table 1, the rate of a welding excellent article and the rate of an impact excellent article of the prototype cells 1 and 2 whose thickness of a metallic thin plate is 0.03mm or less were very bad. By the prototype cell 3 whose thickness of a metallic thin plate is 0.05mm, the rate of a welding excellent article and the rate of an impact become 80%. Furthermore, the thickness of a metallic thin plate showed the result with all very good rate of a welding excellent article, rate of an assembly excellent article, and rates of an impact excellent article by 0.07mm or more. Moreover, as the prototype cell 11 showed, as for all of the rate of a welding excellent article, the rate of an assembly excellent article, and the rate of an impact excellent article, the thickness of a metallic thin plate became 99% by 0.40mm. Since the thickness of the 1st plate is 0.5mm, it is understood that the rate of a welding excellent article, the rate of an assembly excellent article, and the rate of an impact excellent article are very high to 0.40mm which is 80% of the thickness of the 1st plate. However, as the prototype cells 12 and 13 showed, when the thickness of a metallic thin plate was set to 0.45mm or more, the rate of an assembly excellent article fell. The cause by which the rate of an assembly excellent article worsened was because the 1st plate and the 2nd plate short-circuited. A short part is the restoration boundary of the band-like connection section and the active material restoration section, and changed into the condition that the frame of the foaming nickel which is a substrate in this part projected.

[0062] The [prototype cells 14-22], next the prototype cells 14-22 which make Vickers hardness of a metallic thin plate a parameter were produced. The used metallic thin plate is a nickel ribbon which sets width of face of 1.5mm, and thickness to 0.07mm, and the griddle which performed nickel plating with a Vickers hardness [150] and a thickness of 0.40mm was used for the collecting electrode plate as well as said prototype cells 1-13.

[0063] The Vickers hardness of a metallic thin plate was changed in 30-350. Vickers hardness 30-70 was changed for every 20, and 100-350 considered it as 50 units. The result of having measured the rate of an excellent article of the prototype cell which made the Vickers hardness of a metallic thin plate as an experiment as 30-350 is shown in Table 2.

[0064]

[Table 2]

金属薄板のビッカース硬度を３０～３５０とした場合の溶接良品率、組立良品率、衝撃良品率

試作電池	金属薄板ビッカース硬度	溶接良品率（%）	組立良品率（%）	衝撃良品率（%）
14	30	85	99	60
15	50	98	99	99
16	70	99	99	99
17	100	99	99	100
18	150	99	99	100
19	200	99	99	100
20	250	99	99	100
21	300	99	89	97
22	350	99	60	90

[0065] As shown in Table 2, the range of the Vickers hardness of a metallic thin plate is 50-250, and it showed the result that the rate of a welding excellent article, the rate of an assembly excellent article, and the rate of an impact excellent article excelled extremely. In Vickers hardness 30 of the prototype cell 14, although only the rate of an assembly excellent article is as high as 99%, the rate of a welding excellent article and the rate of an impact excellent article are 85% and 60%, respectively, and are falling a little. Moreover, although the rate of a welding excellent article of the with a Vickers hardness of 300 or more prototype cells 21 and 22 was as high as 99%, the rate of an assembly excellent article and the rate of an impact excellent article fell a little. Therefore, as for the best result being shown, the Vickers hardness of a metallic thin plate serves as the range of 50-250.

[0066] [Prototype cells 23-31] The prototype cells 23-31 which make Vickers hardness of a collecting electrode plate a parameter were produced further. The metallic thin plate used here is a nickel ribbon made into 0.07mm in width of face of 1.5mm, and thickness, and Vickers hardness 150. The griddle which performed nickel plating with a thickness of 0.40mm was used for the collecting electrode plate.

[0067] The Vickers hardness of a collecting electrode plate was changed in 30-350 as well as the Vickers hardness of the metallic thin plate of the above-mentioned prototype cells 14-22. 30-70 mince the Vickers hardness of a collecting electrode plate 20, and 100-350 are considering it as 50 units. The result of having measured the rate of a welding excellent article of the prototype cell which made the Vickers hardness of a collecting electrode plate as an experiment as 30-350, the rate of an assembly excellent article, and the rate of an impact excellent article is shown in Table 3.

[0068]

[Table 3]

集電板のビッカース硬度を３０～３５０とした場合の溶接良品率、組立良品率、衝撃良品率

試作電池	集電板ビッカース硬度	溶接良品率（%）	組立良品率（%）	衝撃良品率（%）
23	30	85	99	30
24	50	98	99	99
25	70	99	99	99
26	100	99	99	100
27	150	99	99	100
28	200	99	99	100
29	250	99	99	100
30	300	90	89	97
31	350	33	60	90

[0069] As shown in the above-mentioned table 3, the result high in 50-250 was shown about the Vickers hardness of a collecting electrode plate as well as the trial of the Vickers hardness of said metallic thin plate. In Vickers hardness 30 of the collecting electrode plate which the prototype cell 23 shows, although the rate of an assembly excellent article was as high as 99%, they were 85% of rates of a welding excellent article, and 30% of rates of an impact excellent article. Moreover, in Vickers hardness 300, as the prototype cell 30 shows, 90%, the rate of an assembly excellent article becomes 89%, and the rate of a welding excellent article falls a little. In Vickers hardness 350, the rate of a welding excellent article, the rate of an assembly excellent article, and the rate of an impact excellent article fell further.

[0070]

[Effect of the Invention] The cell of this invention ensures joining of an electrode group and a collecting electrode plate, and prevents cutoff and short-circuit of electrical installation, and the features moreover made to a reliable cell in a high-rate-discharge property are realized. That is because the cell of this invention makes an optimum value the thickness and Vickers hardness of a metallic thin plate by which joining is carried out to the band-like connection section, and joining can be performed certainly and the shock resistance at the time of use is also improving. The collecting electrode plate has especially the thickness which certainly welds the cell of this invention with sufficient reinforcement for the band-like connection section of an electrode group in the production process of a cell. Moreover, since it is considering as the degree of hardness to which deformation required at the time of manufacture can perform Vickers hardness of a metallic thin plate enough, to coincidence, troubles, such as internal short-circuit at the time of cell manufacture, are also avoidable, and the features improved by step stop are also realized to it.

[0071] Furthermore, in addition, it is an impact at the time of dropping or throwing a cell at the time of the use after cell manufacture, and the cell of this invention which has moderate buffer nature and sufficient reinforcement improves shock resistance as structure where the electrical connection of an electrode plate and a collecting electrode plate is hard to be severed, it is highly efficient and can offer a reliable cell.

[0072] Moreover, the cell of this invention is considering as the optimal range which maintained the balance to which the deformation at the time of sufficient reinforcement and manufacture can perform enough the Vickers hardness and thickness of the collecting electrode plate by which joining's is carried out to the band-like connection section to which joining of the metallic thin plate was carried out, and has realized more positive joining. Especially, by the cell of this invention, the conventional not a sintering type electrode but non-sintering electrode are used, and the outstanding cell which can realize cost reduction and high energy consistency-ization to coincidence can be used still more conveniently. That is because it can set to manufacture the non-sintering electrode in which high rate discharge is possible, and

this invention is considering as the optimal degree of hardness concerning the cell of this invention, and can strengthen electric connection between a collecting electrode plate and an electrode group and the exfoliation accident of the terminal at the time of manufacture and use can be prevented.

[0073] Although substrates, such as a punching metal, are being used for a sintering type electrode, with the non-sintering electrode, three-dimension metal porous bodies, such as foaming nickel, are being used for it as a substrate. However, welding with a collecting electrode plate is difficult for the non-sintering plate which uses a three-dimension metal porous body as a substrate, and it has a possibility that current collection nature may become inadequate and a terminal may exfoliate by the impact. On the other hand, it is adjusted to the optimal range which maintained space-saving, the cell of this invention holding sufficient reinforcement for the thickness of the metallic thin plate by which joining is carried out to the band-like connection section. Furthermore, it is so high that an impact is fully borne, it is low so that joining at the time of manufacture can fully be performed by one side, and the degree of hardness is also improving shock resistance by adjusting the optimal. Moreover, the cell of this invention is considering as the optimal range which maintained the balance to which the deformation at the time of sufficient reinforcement and manufacture can perform enough the degree of hardness of the collecting electrode plate by which joining's is carried out to the band-like connection section to which joining of the metallic thin plate was carried out, and is improving shock resistance more.

[0074] The cell indicated by claim 3 of this invention further again has prepared the projection in the collecting electrode plate with the through tube, and can perform joining still more easily and certainly. For this reason, the features that the very user-friendly cell which improves further and can use safely and conveniently low cost and not only high rate discharge but dependability can be offered are realized.